

REMARKS

Applicants wish to thank the Examiner for the telephonic interview conducted on December 13, 1999 with R. Lee Fraley, counsel for the Applicants. During the interview, counsel for Applicants and the Examiner briefly discussed the previous rejections with respect to the Reissue Declarations, as well as the claims of the present invention in light of the prior art cited. As Applicants' counsel explained in the interview, none of the cited prior art teaches or suggests the forming of "fluff" on a polishing surface such that the polishing cloth can continuously polish the semiconductor device, as called for in various of the subject claims. As a result, as will be explained in greater detail below, Applicants believe the pending claims define patentable subject matter, and thus respectfully request reconsideration and allowance of the pending claims.

In the Office Action dated July 12, 1999, the Examiner rejected all of the claims (claims 1-21) pending in the present application. Applicants respectfully request reconsideration of the application in view of the following remarks.

Initially, the Examiner contends that the reissue oath/declaration filed with the application is defective because none of the errors which are relied upon to support the reissue application are errors upon which a reissue can be based, citing 37 CFR §1.175(a)(1) and MPEP §1414. Further, the Examiner contends that the reissue oath/declaration is defective because it fails to particularly specify the errors and/or how the errors relied upon arose or occurred as required under 37 CFR §1.175(a)(5), and thus contends that claims 1-21 stand rejected as being based upon a defective reissue declaration under 35 USC 251. Applicants respectfully traverse these rejections.

Under the rule changes effective December 1, 1997, 37 CFR §1.175(a) requires that the oath/declaration merely state that:

(1) the applicant believes the original patent to be wholly or partly inoperative or invalid by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than the patentee had the right to claim in the patent, stating at least one error being relied upon as the basis for reissue; and

(2) all errors being corrected in the reissue application up to the time of filing of the oath or declaration under this paragraph arose without any deceptive intention on the part of the applicant.

In other words, all that is required under the current statute, which is in effect, is a statement that at least one error is being relied upon as the basis for reissue, and that all errors being corrected in the reissue application arose without any deceptive intention on the part of the Applicants. In an abundance of caution, Applicants' representative confirmed this interpretation of the statute via telephonic conversation on September 2, 1999 with Steven Marcus, Special Programs Examiner for Group 3723.

As set forth in the Reissue Declarations of inventors Mr. Sugiyama and Mr. Arai, as well as Applicants' counsel, Mr. Womack and Mr. Schmelzer, the errors in the originally issued claims related to the existence of an unnecessary limitation in claims 1, 6, and 11 that the tool (claims 1 and 6) or tool arm (claim 11) for forming the "fluff" on the polishing pad be "moved along a radial direction of the polishing cloth and perpendicular to the radial direction." Thus, the original patent is wholly or partly inoperative by reason of the Applicants claiming less than they had a right to claim in the patent. Further, as set forth in each of the Declarations, the errors arose without any deceptive intention on the part of Applicants or Applicants' counsel.

In addition, Applicants have further amended claim 1 to remove another unnecessary limitation that rendered U.S. Patent No. 5,605,499 wholly or partly inoperative or invalid by reason of the Applicants claiming less than they had a right to claim in the patent. In particular, the errors in, and insufficiency of, the originally issued claim 1 relates to the existence of an unnecessary limitation that the tool for conditioning (*i.e.*, for forming the "fluff" on) the polishing cloth have "an annular shape." As described in the specification, and as one skilled in the art will appreciate, this limitation of shape of the conditioning tool is not necessary. Any configuration of the tool which effects conditioning of the polishing cloth will suffice. Thus, this limitation unnecessarily limits claim 1.

In that Applicants have corrected an error not covered by the original Reissue Declarations of inventors Mr. Sugiyama and Mr. Arai, pursuant to the requirements of 37 CFR §1.175(b), Applicants respectfully submit Supplemental Reissue Declarations of the inventors that state every error in the present Reissue application arose without any deceptive intention on the part of the Applicants.

Accordingly, the requirements of 37 CFR §1.175(a) and (b) for oath/declarations are met, and thus the Reissue Declarations in question, and the newly submitted Supplemental Declarations, can be fully relied on in support of the reissue application. Applicants respectfully request withdrawal of the rejection of claims 1-21 based upon a defective reissue declaration under 35 USC §251.

In addition, claims 1-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hirose et al., U.S. Patent No. 5,384,986, issued January 31, 1995, in view of Jackson et al, U.S. Patent No. 5,456,627, issued October 10, 1995. While referring to Figures 1-3 and the specification from column 4, line 25 through column 6, line 32, the Examiner contends that Hirose discloses the claimed invention except for explicitly disclosing the dressing being done during polishing. Further, while referring to Figures 1-5 and the specification from column 2 line 44 through column 5, line 14, the Examiner contends that Jackson discloses a conditioner for a polishing pad, wherein the conditioning of the pad may alternately take place while the device surface of a wafer is being polished or while it is not being polished. Additionally, the Examiner alleges that it would have been obvious to modify the operating method of Hirose with the conditioning of the polishing cloth while the wafer is being polished as taught by Jackson to maintain the integrity of the polishing cloth in-situ to improve the planarity of the wafer surface. Applicants disagree and respectfully traverse the rejection of these claims.

Hirose discloses a polishing apparatus having a dressing device for dressing an abrasive cloth used for polishing a wafer. The dressing device comprises a rotating brush that is rotatably configured about a vertical axis extending perpendicularly to the abrasive cloth, with the rotating brush facing towards the abrasive cloth. The purpose of the rotating brush is to remove abrasive materials or grains from the abrasive cloth. Additionally, with reference to Figures 4(a) through 4(c), "the brush 22 is angularly moved back and forth [in an arcuate path] over a certain position radially with respect to the abrasive cloth 3, [such that] the abrasive cloth 3 is napped in opposite directions at that position, allowing the clogging abrasive grains to be expelled effectively from the abrasive cloth 3 by the cleaning solution W and under the centrifugal forces." (Column 6, lines 10-16).

Applicants confirm the Examiner's assessment that Hirose fails to disclose the dressing of the abrasive cloth during the polishing of the wafer. However, as discussed with the Examiner during the interview, Hirose also fails to disclose the dressing of a polishing cloth to form "fluff" thereon,

but instead merely teaches the removal of abrasive grains from a polishing cloth to sustain a longer service life. In the present invention, “the fluffs, i.e., a surface layer, [are] intended to be formed on a polishing cloth.” (Applicants specification, column 4, lines 12-13). These fluffs are preferably greater than $30\mu\text{m}$ in height, for example, $70\mu\text{m}$ in height, after surface layer formation. (Applicants specification at column 7, lines 26-38, and figures 10, 12 and 14). Moreover, a function of such “fluffs” is to retain abrasive particles for flattening the semiconductor device. (Applicants specification at column 7, lines 47-57). However, as one skilled in the art would appreciate, the abrasive cloth of Hirose comprises a conventional, unwoven-type cloth having a soft material surface. Moreover, the brush of Hirose is merely configured to remove materials imbedded within the soft, abrasive cloth. Accordingly, the brush of Hirose would not operate to form “fluff” upon the synthetic resin polishing cloth of the present invention.

On the other hand, Jackson discloses an apparatus for conditioning the surface of a polishing pad including an end effector that is moved radially on the surface of the polishing pad. The end effector is coupled to a drive mechanism included within a cantilever that is fixedly maintained over a polishing surface. Jackson discloses that when a polishing pad is axially rotated, locations on the polishing pad surface have linear velocities that are not uniform, i.e., the respective linear velocities of the locations are non-uniform. Thus, Jackson contends that the simple movement of an end effector in an arcuate path over a polishing surface, e.g., like a phonograph needle moving over a phonograph record mounted on the turntable of a record player, results in conditioning of the polishing surface that is non-uniform, thereby resulting in a non-uniform polishing of the wafer surface. (Column 1, lines 45-58).

Accordingly, Jackson teaches the use of a motor assembly connected to a lead screw such that when the lead screw is rotated in one direction, the end effector moves directly radially across the polishing pad, i.e., not in an arcuate path, in response to the rotation of the lead screw. More specifically, Jackson teaches that the radial movement of the end effector is controlled by a velocity servo that varies the radial movement at a velocity to compensate for locations on the polishing pad surface having linear velocities that are directly related to their respective radii.

In contrast to the methods and apparatus employed by Hirose or Jackson, the method and apparatus recited in claims 1-13 utilize a tool or tool arm for creating fluff on a polishing surface such

that the polishing cloth can continuously polish the semiconductor device. For example, independent claim 1 recites “a tool for forming a surface layer of the synthetic resin polishing cloth to have fluff thereon in a polishing process”, with the “tool being moved to form the fluff on the polishing cloth so that the polishing cloth can evenly and continuously polish the semiconductor device.” Claim 6 recites that “a tool for forming a surface layer of the synthetic resin polishing cloth to have fluff thereon”, with the “tool being moved to form the fluff on the polishing cloth...to recreate a surface shape thereof so that the polishing cloth can evenly and continuously polish the semiconductor device.” Similarly, independent claim 11 recites that an apparatus for flattening a semiconductor device comprises a “device for forming a surface layer of the polishing cloth having fluff thereon”, and “a tool arm connected to the forming device, said tool arm being moved to form the fluff on the polishing cloth while polishing is being made by the polishing cloth.” Each of these independent claims recite elements that are neither taught nor suggested by Hirose or Jackson.

As recognized by the Examiner, Hirose fails to disclose the dressing of the abrasive cloth during the polishing of the wafer. However, Hirose also fails to teach or suggest other elements of the claimed invention, including the failure to dress the polishing cloth to form a fluff thereon such that the polishing cloth can continuously polish the semiconductor device.

Additionally, while Applicants agrees that Jackson discloses that the controlled conditioning of a polishing pad, i.e., by controlling the velocity of radial movement to compensate for locations on the polishing pad having different linear velocities, may alternatively take place while the device surface of wafer is being polished or while it is not being polished, Jackson fails to disclose that the conditioning of the polishing pad provides fluff thereon such that the polishing cloth can evenly and continuously polish the semiconductor device as set forth in independent claims 1 and 6, or a device for forming a surface layer of the polishing cloth having fluff thereon while polishing of the semiconductor device is being conducted, as set forth in claim 11. In other words, as Applicants’ counsel explained during the aforementioned interview, Jackson fails to even recognize or appreciate the problems solved by the present invention, namely the need for improved uniformity. “The determination of whether a novel structure is or is not ‘obvious’ requires cognizance of the properties of that structure and the problem which it solves, viewed in light of the teachings of the prior art.” In re Wright, 848 F.2d 1216, 1219 (Fed. Cir. 1988). Jackson merely discloses that “the conditioning of

pad 20 may alternatively take place while the device surface of wafer 70 is being polished or while it is not being polished.” No further discussion of this alternative operation is described by Jackson, and clearly no suggestion or appreciation of the problem as recognized by the present invention is taught by the Jackson reference. As disclosed throughout Applicants’ specification, by dressing the polishing cloth to have fluff thereon during the polishing of the semiconductor device, a more constant pressure and polishing rate can be provided to achieve improved uniformity of the semiconductor device. (For example, Applicants specification at column 8, lines 11-23). Accordingly, Jackson fails to teach or suggest the features of independent claims 1, 6 and 11.

Moreover, the methods and apparatus of Hirose and Jackson teach completely different approaches to dressing a polishing cloth. For instance, Hirose teaches the removal of the abrasive material from the soft abrasive cloth by a rotating brush to prepare the cloth for reuse, with the brush oscillating radially in an arcuate path across the abrasive cloth such that any given portion of the abrasive cloth is swept in opposite directions by the rotating brush, thus removing clogging caused by the abrasive materials. In other words, Hirose teaches the oscillating of the brush in an arcuate path much like a phonograph needle to remove abrasive matter located within the abrasive cloth. (See Hirose at figures 4(a)-(c), and specification at column 5, lines 42-47 and column 6, lines 7-32). On the other hand, Jackson teaches that such movement in an arcuate path causes non-uniformities during the polishing process (See Jackson, column 1, lines 51-57). Further, Jackson teaches the controlled conditioning of the end effector to vary the velocity of the radial movement of the end effector to compensate for locations on the polishing pad having different linear velocities. Moreover, this radial movement is controlled by the lead screw 32 in the rotatable cantilever arm 10 to “cause line 34 to be along a radius of pad 20, thereby causing end effector 22 to move radially across polishing pad surface 18 in response to a rotation of lead screw 32.” (Column 3, lines 35-48). Accordingly, Jackson teaches away from the arcuate path oscillation of Hirose. “Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined only if there is some suggestion or incentive to do so.” ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577 (Fed. Cir. 1984). Here, one would not be motivated to combine Hirose and Jackson to meet Applicants claims.

Furthermore, even if the method of Hirose was modified with the conditioning of the polishing cloth taught by Jackson as proposed by the Examiner, the modified Hirose method would only operate to remove abrasive particles from the polishing cloth during the polishing of the semiconductor device surface, not to dress the polishing cloth to form fluff thereon such that the polishing cloth can evenly and continuously polish the semiconductor surface. Additionally, it is doubtful that Hirose would work for its intended purpose if operated during the polishing of a semiconductor device. Since Hirose teaches the removal of abrasive grains from the polishing cloth, any such grains are “expelled effectively from the abrasive cloth 3 by the cleaning solution W and under the centrifugal forces.” (Column 6, lines 14-16). As such, it is likely that these grains would find their way in between the polishing cloth and the wafer surface, thus resulting in ineffective polishing of the wafer surface.

Still further, in that Jackson requires the elimination of the movement of the end effector in an arcuate path, use of the supporting arm of Hirose would prevent the apparatus of Jackson from operating properly. Accordingly, independent claims 1, 6 and 11, and claims 2-5, 7-10, 12 and 13 which variously depend from claims 1, 6, and 11, are patentable over Hirose or Jackson, alone or in combination.

Applicants also submit that claims 3-7 and 9-11 are patentable over the prior art of record for additional reasons. Claims 3 and 9 recite that said synthetic polishing cloth has a hardness of higher than 80 measured by a c scale according to JIS-6301, while claims 4 and 10 recite a hardness from 90 to 110. Claims 5 and 7 recite that the fluff formed on the polishing cloth retains abrasive particles therein for flattening the semiconductor device. Claim 6 recites that the tool has “an annular shape” while claim 11 recites that the forming device has an “annular shape.” Neither Hirose or Jackson teach or disclose such a synthetic polishing cloth or such a tool or device for dressing a polishing cloth.

Applicants also submit that independent claim 14 is patentable under 35 U.S.C. §103(a) for additional reasons. Claim 14 provides a flattening apparatus having a device for recreating a surface shape of the polishing cloth, with the recreating device having “a surface shape recreating face with a curvature in a radial direction thereof to which the semiconductor device slidably contacts and being actuated while the semiconductor device is being polished by the flattening device to recreate the polishing cloth continuously.” As explained in the specification, by configuring the polishing cloth surface to have the same curvature of the backing pad surface of the semiconductor wafer, for

example, with a flat shape, convex shape or concave shape or the like, high uniformity can be obtained. (Column 8, lines 24-57). In other words, by configuring the flatness of the backing pad in accordance with the surface shape of the polishing cloth, the semiconductor wafer can be pressed against a polishing surface of the polishing cloth with uniform pressure. (Column 13, lines 49-52). Neither Hirose nor Jackson teach or suggest such a configuration for providing "a surface shape recreating face with a curvature in a radial direction thereof to which the semiconductor device slidably contacts and being actuated while the semiconductor device is being polished by the flattening device to recreate the polishing cloth continuously." For the above reasons, independent claim 14, and claims 15-21 which variously depend from claim 14, are not unpatentable over Hirose or Jackson, alone or in combination. Accordingly, Applicants respectfully request withdrawal of the §103 rejection of those claims.

In view of the foregoing, Applicants respectfully submit that all of the pending claims fully comply with 35 U.S.C. §112 and are allowable over the prior art of record. Reconsideration of the application and allowance of all pending claims is earnestly solicited. As Applicants' counsel discussed during the aforementioned interview, should the Examiner wish to discuss any of the above in greater detail or deem that further amendments should be made to improve the form of the claims, then the Examiner is invited to telephone the undersigned at the Examiner's convenience.

Respectfully submitted,

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